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SPECIFICATION FOR
Procurement of Nuclear Grade High Efficiency Particulate Air
(HEPA)
Filter Sizes and Shapes NOT Covered by ASME AG-1

System No. N/A
Equipment No. N/A

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1.0 SCOPE

This specification is for the procurement of High-Efficiency Particulate Air (HEPA) filters used in nuclear air or gas treatment facilities or systems. This specification covers Self-Contained, Fire, and Moisture Resistant (SCFMR), Self-Contained, Fire, Moisture, and Chemical-Resistant (SCFMCR), and Self-Contained, Fire, Moisture, High- Temperature, and High Humidity Resistant (SCFMHTHHR) filters. This specification also covers other shapes and configurations such as round or rectangular.

The filter sizes and media furnished in accordance with this specification shall comply, as a minimum, with the requirements of the Institute for Environmental Sciences IES-RP-CC001.3 or applicable sections of the American Society of Mechanical Engineers (ASME) AG-1-1991 (latest addenda), Section FC and Appendix FC-I.

The requirements for compliance with ASME AG-1 are set forth in Washington Administrative Code (WAC), Chapter 246-247.

2.0 PURPOSE

The purpose of this specification is to ensure that HEPA filters used in confinement systems are acceptable in all aspects of performance, design, construction and testing.

3.0 APPLICABILITY

This specification applies to extended-media dry type filters for use in air and gas streams with fire, moisture, temperature, chemical and humidity requirements as defined within the body of this specification.

As a minimum, filters procured under this specification shall meet the primary requirements of IES-RP-CC001.3 Section 6 (Allowable Materials), Section 7 (Design), Section 8 (Construction Requirements), Section 9 (Testing), Section 10 (Marking), and Section 11 (Quality Assurance). Other requirements may be used per ASME AG-1 as required to assure the procurement and use of the best product for the functional need.

4.0 LIMITATIONS

This specification covers self-contained (also known as nipple- connected) filters or other sizes and shapes not covered by ASME AG-1, Table FC-4100-1. For filter sizes shown in Table FC-4100-1, refer to procurement specification HS-V-P-4042. Every effort should be made to use the filter sizes as shown in ASME AG-1.

IES-RP-CC001.3 does not limit itself to particular sizes or shapes, but delineates quality of materials and workmanship.

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<p>Wood particle board, plastic material or aluminum alloy frames (cases) are not covered by this specification.</p> <p>5.0 DEFINITIONS AND TERMS</p> <p>1. <u>Acceptance Test</u></p> <p>Inspection and test of a qualified filter to verify certain specified characteristics or properties, the results of which determine the acceptance or rejection of that filter.</p> <p>2. <u>High Efficiency Particulate Air (HEPA) Filter</u></p> <p>A filter having a fibrous medium with a particle removal efficiency of at least 99.97% for 0.3 micro-meter particles of an approved test aerosol.</p> <p>3. <u>Penetration</u></p> <p>The amount of leakage through or bypassing a filter, expressed as a percentage of the upstream concentration of an approved test aerosol, when the filter is encapsulated in a test chamber (chuck) and operated under specified conditions.</p> <p>4. <u>Qualification Test</u></p> <p>A test, often destructive, of a prototype or randomly selected production filter to establish its capability to meet certain functional and specification requirements, the results of which are considered to typify subsequent filters of the same design (includes materials and configuration, size may vary) and manufactured by the same process.</p> <p>5. <u>Self-Contained, Fire, and Moisture Resistant (SCFMR) Filter</u></p> <p>A filter meeting the functional and design requirements of a fire and moisture resistant HEPA filter. The filter assembly shall be capable of continuous operation at 200E F (93E C).</p> <p>6. <u>Self-Contained, Fire, Moisture, and Chemical Resistant (SCFMCR) Filter</u></p> <p>A filter meeting the functional and design requirements of a fire, moisture, and chemical resistant HEPA filter. The filter assembly shall be capable of continuous operation at 200E F (93E C).</p> <p>7. <u>Self-Contained, Fire, Moisture, High Temperature, and High Humidity Resistant (SCFMHTHR) Filter</u></p> <p>A filter meeting the functional and design requirements of a fire, moisture, high temperature, and high humidity filter. The filter assembly shall be capable of continuous operation at 500E F (260E C).</p> <p>8. <u>Testing Method</u></p>							

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Testing method per IES-RP-CC001.3, Section 9; or ASME AG-1, Article FC-5120 (e.g., Q107); or the High Flow Alternative Test System (HFATS), whichever provides the assurance of a quality filter.

6.0 REFERENCED DOCUMENTS

The standards and specifications designated below are a part of this specification to the extent specified herein. The most current revisions of standards and specifications apply.

- American Society of Mechanical Engineers (ASME)
 - ! ASME AG-1 Code on Nuclear Air and Gas Treatment
 - Division I General Requirements, Section AA, Common Articles
 - Division II Ventilation Air Cleaning and Ventilation Air Conditioning, Section FC, HEPA Filters
- American Society for Testing and Materials (ASTM)
 - ! ASTM A 167, Rev A Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - ! ASTM A 176 Standard Specification for Stainless and Heat-Resisting Chromium-Steel Plate, Sheet, and Strip
 - ! ASTM A 240/A 240M Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
 - ! ASTM A 653/A 653M Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - ! ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test
 - ! ASTM-E84 Surface Burning Characteristics of Building Materials
- American Wood-Preservers Association (AWPA)
 - ! AWPA C27 Plywood--Fire-Retardant Pressure Treatment
- Institute of Environmental Sciences (IES)
 - ! IES-RP-CC001.3 HEPA and ULPA Filters
- National Institute of Standards and Technology (NIST)

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! NIST PS 1

NIST Voluntary Product Standard, Construction and Industrial Plywood

6. Washington Administrative Code (WAC)

! Chapter 246-247

Radiation Protection - Air Emissions

7.0 ALLOWABLE MATERIALS

1. Materials shall meet the requirements of IES-RP-CC001.3 as a minimum. ASME AG-1, Section FC, may be used as an alternative. For manufacturer proprietary material or materials listed as "Manufacturer's option," the Seller shall submit the material specification to the Buyer for information as a part of the bid quotation.

2. Filter Media

The filter media shall comply with IES-RP-CC001.3, Paragraph 6.5.

- SCFMCR: Filter media shall not contain more than 7% by weight of carbonaceous fibers.

3. Frame (Case)

Frame material shall comply with IES-RP-CC001.3, Paragraph 6.1, "Frame"; 6.1.1, "Cold-Rolled Steel Sheet"; 6.1.2, "Galvanized Steel Sheet"; 6.1.3, "Stainless Steel"; or 6.1.4, "Plywood", except as noted below:

a. **Galvanized Carbon Steel**

- SCFMCR: In accordance with ASTM A 653/A 653M, coating weight designating G90 maximum, 16 gage (1.4 mm) minimum sheet thickness.

b. **Stainless Steel**

- SCFMCR: In accordance with ASTM A 176, Type 409 (muffler grade ferritic stainless steel), 16 gage (1.4 mm) minimum sheet thickness.

- SCFMCR: In accordance with ASTM A 167 or ASTM A 240, Type 304, 304L, 316, or 316L, 16 gage (1.4 mm) minimum sheet thickness.

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c. Plywood

Plywood shall be in accordance with NIST PS-1, Type III or IV per ASME AG-1, Article FC-3110. The plywood shall be fire retardant treated in accordance with AWWA C27, and tested in accordance with ASTM-E84.

4. Separators

The separators shall comply with IES-RP-CC001.3, Paragraph 6.4, except as noted below:

- SCFMCR: Separators shall be coated with teflon, epoxy resin, thermoset vinyl, or other acid resistant material. The coating shall be colored (to permit defects in the coating to be discerned); shall be tightly adherent and not crack or delaminate when the material is corrugated; and shall be at least 0.0001 to 0.0002 in. (2.5 to 5 mm) thick (dry film). After corrugation and subsequent flattening, the coating shall exhibit an adhesive peel resistance of 3A or greater when tested in accordance with Method A of ASTM D 3359.

5. Adhesive/Sealants

The adhesive/sealants shall comply with IES-RP-CC001.3, Paragraph 6.3, or ASME AG-1, Section FC-3150, except as noted below:

- SCFMR: Resistance to water, oil, ozone, and radiation
- SCFMCR: Resistance to water, oil, ozone, chemical, and radiation

6. Gaskets and Seals

Gasket material shall be in compliance with IES-RP-CC001.3, Paragraph 6.2 as a minimum. If gelatinous seal is required, refer to ASME AG-1, Article FC-3122.

7. Faceguards

When faceguards are required, they shall comply with ASME AG-1, Article FC-3140, except as noted below:

- SCFMCR: 4 X 4 mesh, 23 gage (.566 mm) stainless steel hardware cloth, ASTM Type 304 or 316, standard grade

8. Fasteners

The use of fasteners in the filter assembly is the manufacturer's option. For SCFMR, SCFMCR and SCFMHTHHR filters, fasteners shall be made of corrosion resistant material or have a corrosion resistant coating.

8.0 DESIGN AND CONSTRUCTION REQUIREMENTS

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- Filter design shall meet, as a minimum, the requirements of IES-RP-CC001.3, Section 7.
- Filter construction shall meet, as a minimum, the requirements of IES-RP-CC001.3, Sections 5 and 8.
- Each filter shall be designated:
 - ! Type A, B, C, or D per IES-RP-CC001.3, Section 4,
 - ! Construction Grade 1, 2, 3, 4, 5 or 6 per IES-RP-CC001.3, Section 5, and
 - ! include the special material requirements of Section 7 of this specification for a SCFMR, SCFMCR, or SCFMHTHHR filter.
- Filter splices and patches shall not be spliced or patched.
- Filters shall pass the performance tests identified in IES-RP-CC001.3, Section 9.

9.0 INSPECTION AND TESTING

- Qualification Testing**

The filter Manufacturer shall be able, on request, to show evidence that qualification tests have been conducted in accordance with and meet the requirements of IES-RP-CC001.3, Section 9, Table 1, for the type of filter chosen. These tests shall be performed under acceptably controlled conditions, either by the filter Manufacturer or an independent laboratory. Records shall be prepared and maintained which show evidence that the tests are performed in an acceptably controlled manner.

 - Filter Media**

For filter media, documented tests performed by the media Manufacturer or a testing lab can be used to demonstrate compliance with filter media requirements.

Resistance to Radiation - as identified in Appendix FC-I3000 and FC-I-4000.
 - Filters**

Filters for qualification shall be either prototypes of the proposed design or production filters of the specific design randomly selected from the Manufacturer's stock. The number of filter units required for qualification testing shall be as specified in ASME AG-1, Article FC-5100.

 - Resistance to Airflow - Article FC-5110, or specify different functional requirements
 - Test Aerosol Penetration - Article FC-5120, or specify different functional requirements

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- Resistance to Rough Handling - Article FC-5130, or specify different functional requirements
- Resistance to Pressure - Article FC-5140, or specify different functional requirements
- Resistance to Heated Air - Article FC-5150, or specify different functional requirements
- Spot Flame Resistance - as identified in Article FC-5160, or specify different functional requirements
- Production Testing - as identified in Article FC-5200, or specify different functional requirements
- Recertification and Qualification - The Buyer may have qualification tests, or verifications of materials, performed on any filters furnished to them. Failure of filters submitted for qualification testing to meet any requirement shall be cause for a re-evaluation of the Supplier's quality assurance program.

2. **Production**

Production testing shall meet the requirements of ASME AG-1, Article FC-5200.

10.0 FABRICATION

Each filter shall be assembled from materials identified in Section 7 of this specification and shall be manufactured and assembled to meet all tolerances. The media shall be installed with quality workmanship. The fabrication shall meet ASME AG-1, Articles FC-6200, FC-6210, FC-6211, FC-6212, FC-6220 and FC-6300.

11.0 PACKAGING, SHIPPING AND STORAGE

Packaging, shipping and storage shall comply with IES-RP-CC001.3, Section A3, Appendix A.

1. **Loading in Public Carriers**

Pallets shall not be stacked without sufficient support(s) to prevent damage to the bottom filters. Other materials shall not be stacked on top of the boxes during shipment.

2. **Shipment**

If possible, shipment shall be arranged so that the filter assemblies are not disturbed after they leave the Seller until they are received at the address designated by the Buyer. For large shipments, it is recommended that the entire shipment be shipped in a sealed dedicated trailer or rail car. At all times, the filters must be handled with care. The common carrier shall be instructed that the Buyer's personnel will be responsible for unloading at the Buyer's

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receiving.

12.0 **QUALITY ASSURANCE PROVISIONS**

1. **Supplier Quality Assurance Program**

- a. The Supplier shall have a documented quality program that is in compliance with ASME AG-1, Articles FC-8000 and AA-8000. The quality program shall ensure that the supplied products and services meet or exceed contract requirements. This program shall be evaluated by the Buyer's Quality Assurance organization. The Seller must successfully disposition any resulting findings or observations prior to award of contract.
- b. The Supplier's program shall be subject to review at all times by the Buyer. The Buyer reserves the right to verify the quality of work at the Supplier's facility, including any subcontractor's facility.
- c. The Supplier shall, during the performance of this Purchase Order, submit proposed changes to the quality assurance program to the Buyer for review prior to implementation.

2. **Acceptance Inspection and Testing**

- a. Each shipment shall be accompanied by a Supplier certificate of conformance which meets the requirements of ASME AG-1, Article FC-8200.
- b. The Seller shall supply evidence of compliance with the requirements of this specification.
- c. Payment will not be made by the Buyer until each filter has been Accepted by Quality Assurance. Failure to meet inspection, test, or verification requirements shall be cause for rejection.
- d. The Seller shall be notified by the Buyer of rejected filters including the nature of the rejection. The Seller shall provide replacement filters until the stipulated quantity of filters has been found acceptable, unless otherwise negotiated between the Buyer and Seller. The Seller shall provide, at the discretion of the Buyer, replacement filters and/or credit for any rejected filters.

3. **Optional Testing**

The Buyer may elect to have additional testing performed by an independent laboratory. In addition to the aforementioned testing and acceptance criteria, Buyer acceptance of the filters shall be dependent on meeting these additional test requirements.

4. **Quality Assurance Program, Procedures, and Documentation**

Filters shall be manufactured and shipped under a quality assurance program meeting the requirements of ASME AG-1, Articles FC-8000 and AA-8000.

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13.0 **NAMEPLATES**

The filter package nameplate and filter marking shall comply with IES-RP-CC001.3, Section 10.

14.0 **APPENDIX: INSTRUCTIONS FOR COMPLETING THE DESCRIPTION PORTION OF THE PURCHASE DOCUMENT**

The following steps are instructions for completing the filter description portion of the Purchase Document which uses this specification.

1. Attach a copy of this specification to the Purchase Document.
2. Provide the following information in the Purchase Document (order and format):

FILTERS SHALL BE IN ACCORDANCE WITH SPECIFICATION HNF-S-0477.

Exceptions: _____

Name and Acronym of Filter: _____

Size (per Dimensional Description): _____

Filter Type (per Section 8 of this specification): _____

Construction Grade (per Section 8 of this specification): _____

Case - Construction Material Type: _____

Case - Style (flanges): _____

Case - Hardware: _____

Filter/mounting frame seal material type: _____

Filter/mounting frame seal location: _____

Faceguard Material: _____

Faceguard Location(s): _____

QA Clauses: B01 -- QA Program Submittal and Pre-award Survey
 B04 -- Supplier Quality Program Evaluation
 B52 -- Inspection and Test Report

PACKAGING, SHIPPING AND STORAGE SHALL BE IN ACCORDANCE WITH SECTION 11 OF HNF-S-0477.

Additional Shipping Instructions: _____